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Newport, R.I.**

**Command Decision-Making and Information Superiority Vulnerability:
Addressing the Emerging Threat**

by

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A paper submitted to the Faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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ABSTRACT

Command Decision-Making and Information Superiority Vulnerability: Addressing the Emerging Threat

Information superiority rests on a technological foundation that, until now, remained unchallenged. China's anti-satellite test is one example of an emerging threat to United States military dominance in the information domain. Understanding the relationship between information and decision-making enables commanders to understand the implications of threats to information superiority. This paper analyzes "information" in the context of decision-making theory at the operational level. It explores observed trends in command and control caused by the evolution of network-centric warfare and supporting technologies and exposes negative effects. Finally, the paper draws conclusions concerning ways to minimize exposure to vulnerabilities in information technology infrastructure and recommends implementation of measures to optimize decision-making and minimize risk in a disruptive C2 environment.

INTRODUCTION

The United States military currently dominates the conventional warfare environment largely due to superior command and control (C2) of joint and combined forces. Effective C2 hinges upon effective decision-making.¹ Information superiority then becomes an essential precondition to superior C2, facilitating decision-making in order to maintain the initiative at a tempo inside the adversary's decision-making cycle.² Information superiority rests on a technological infrastructure that, until now, remained unchallenged.

U.S. space-based assets are critical elements of the technological infrastructure that enable the U.S. military to manage vast amounts of data and information.³ China clearly recognizes U.S. reliance on space operations and its importance to data and information management as a potential exploitable vulnerability.⁴ China's recent ASAT test exposed the vulnerability of space-based systems.⁵ Whether in conventional or irregular warfare, Combatant and Joint Force Commanders must anticipate an operating environment in which challenges to information superiority disrupt C2. The Combatant and Joint Force Commander's must not respond to these challenges in terms of more technological acquisitions. Through a comprehensive understanding of the relevance of information to decision-making, Combatant and Joint Force Commanders can respond to a disruptive C2 environment by effective delegation of authority, optimization of key phases in the operational planning process, and innovative development of joint task force headquarters in order to reduce the volume of data and information at the operational level.

¹ Paul K. Van Riper, "Information Superiority," *Marine Corps Gazette* 81, no. 6 (June 1997): 58.

² Chairman, U.S. Joint Chiefs of Staff, *Information Operations*, Joint Publication (JP) 3-13 (Washington, DC: Chairman, Joint Chiefs of Staff (CJCS), 13 February 2006), 1.15.

³ Peter B. Teets, "Space Programs Reflect War-Fighting Priorities," *National Defense* 607, no. 88 (June 2004): 33.

⁴ Wang Hucheng, "The US Military's 'Soft Ribs' and Strategic Weaknesses," *Liaowang*, 5 July 2007, <http://www.opensource.gov/> (accessed 3 October 2007).

⁵ Geoff Forden, "A Preliminary Analysis of the Chinese ASAT Test," Powerpoint, 2007.

UNDERSTANDING “INFORMATION” AND MILITARY DECISION-MAKING

There are two steps to understanding the relevance of information to military decision-making. The first involves understanding potentially confusing terminology and theoretical models of decision-making. This helps the commander understand the process of translating elements of the physical world into something upon which the commander can act. The second involves a critical analysis of how well existing systems and processes exploit decision-making theory to assist the commander in making decisions.

The First Step: Terminology and Theory

Terminology

The relationship between information and the cognitive decision-making process is likely not widely understood.⁶ Joint doctrine and policy documents extensively use and describe the term “information.”⁷ Consequently, the meaning of the term gets distorted and muddled. In understanding the decision-making process, it is critical to make important distinctions between seemingly simple words.

There are several relevant distinctions between the physical world and the commander’s decision: data, information, knowledge, and the act of deciding. *Data* represent discrete elements of the physical world. Data are unaltered measurements of physical reality collected by a sensor.⁸ *Information* is the representation of the environment produced by interpretation of

⁶ Alan D. Zimm, “Human-centric warfare,” *United States Naval Institute Proceedings* 125, no. 5 (May 1999), <http://www.proquest.com/> (accessed 3 October 2007): 29.

⁷ U.S. Department of Defense, *Quadrennial Defense Review Report* (Washington DC: Department of Defense, 6 February 2006), 22; Chairman, U.S. Joint Chiefs of Staff, *Joint Vision 2020* (Washington, DC: Government Printing Office, June 2000), 10; Chairman, U.S. Joint Chiefs of Staff, *Joint Operations*, JP 3-0 (Washington, DC: CJCS, 17 September 2006), iv-xxvi; and Chairman, U.S. Joint Chiefs of Staff, *Joint Task Force Headquarters*, JP 3-33 (Washington, DC: CJCS, 16 February 2007), iii-xvii.

⁸ David J. Bryant, “Rethinking OODA: Toward a Modern Cognitive Framework for Command Decision Making,” *Military Psychology* 18, no. 3 (2006): 188.

collected data by a human observer or some other automatic system.⁹ *Knowledge* is a cognitive representation of the environment produced from a synthesis of information within the context of existing mental constructs and judgment.¹⁰ Furthermore, knowledge is separated into explicit knowledge and tacit knowledge. *Explicit knowledge* is derived from codified forms of information in books, manuals, and publications.¹¹ *Tacit knowledge* is derived from experience and memory. Tacit knowledge is difficult to document and is often described in terms of intuition and common sense.¹² Finally, the commander's *decision* is the choice selected from the result of a comparison of existing knowledge to received information.¹³

Existing joint doctrine defines *information superiority* as “the operational advantage derived from the ability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary’s ability to do the same.”¹⁴ *Network-centric warfare* (NCW) is a conceptual framework that generates combat power by establishing connections between geographically dispersed shooters, decision-makers, sensors, communication systems, and databases to achieve improved efficiency in military operations.¹⁵ The NCW approach improves self-synchronization at the tactical level, increases speed of command, promotes shared operating environment awareness, maintains high tempo operations, and increases lethality and

⁹ Carol Leeds et al., “The Knowledge Worker,” (Rapid Assessment Process (RAP) Report #04-1, U.S. Joint Forces Command: Project Alpha, Concept Exploration Department, Joint Futures Lab, Joint Experimentation Directorate (J9), 2003), 2.

¹⁰ Ibid., 3.

¹¹ International Center for Applied Studies in Information Technology, “Intro to KM: Glossary of Knowledge Management (KM) Terms,” <http://www.icasit.org/km/intro/glossary.htm> (accessed 20 October 2007).

¹² Ibid.

¹³ Bryant, “Rethinking OODA,” 183.

¹⁴ Chairman, U.S. Joint Chiefs of Staff, *Department of Defense Dictionary of Military and Associated Terms*, JP 1-02 (Washington, DC: CJCS, 12 April 2001 amended through 12 July 2007), 260.

¹⁵ David S. Alberts, John J. Gartska, and Frederick P. Stein, *Network Centric Warfare: Developing and Leveraging Information Superiority* (1999; repr., Washington DC: Department of Defense C4ISR Cooperative Research Program, 2000), 2.

survivability. By definition, NCW facilitates the translation of information superiority into “operational advantage”.¹⁶

OODA is out, CECA is in: a different model for decision-making

Joint and service doctrines subscribe to the observe, orient, decide, and act (OODA) model of decision-making presented by the late Air Force Colonel John Boyd.¹⁷ David J. Bryant suggests, however, that the OODA loop decision-making model is obsolete and incompletely describes critical processes to operational command and control.¹⁸ Bryant’s model, called the CECA loop (Critique-Explore-Compare-Adapt), specifically addresses cognitive processes required for operational decision-making. The CECA model is more relevant today than the OODA model because the CECA model provides a framework for command decision-making that is more consistent with current cognitive theories of natural decision-making.¹⁹ He convincingly describes the model in the context of the challenges that the operational commander faces by providing broad descriptive framework for describing cognitive processes and discussing ways to enhance command decision-making.²⁰

The basis of the CECA loop lies in the concept of applying and comparing mental models. In the planning phase, the operational commander develops a *conceptual model* of an operational plan. The conceptual model is similar to *vision*, but vision implies a singular point of view, whereas a conceptual model establishes broader boundaries that facilitate sharing the model among individuals. The conceptual model consists of a series of states of the operating

¹⁶ Ibid.

¹⁷ Chairman, U.S. Joint Chiefs of Staff, *Information Operations*, JP 3-13 (Washington, DC: CJCS, 13 February 2006), 1.1; U.S. Air Force, *Information Operations*, Air Force Doctrine Document 2-5 (Washington, DC: Department of the Air Force, 11 January 2005), vii; U.S. Army, *Mission Command: Command and Control of Army Forces*, Field Manual 6-0 (Washington, DC: Headquarters, U.S. Army, 11 August 2003), 4.5; U.S. Marine Corps, *Warfighting*, Marine Corps Doctrinal Publication 1 (Washington, DC: Headquarters, U.S. Marine Corps, 20 June 1997), 102-103; and U.S. Navy, *Naval Command and Control*, Naval Doctrine Publication 6 (Washington, DC: Department of the Navy, Chief of Naval Operations and Headquarters U.S. Marine Corps, 19 May 1995), 17-20.

¹⁸ Bryant, “Rethinking OODA,” 183.

¹⁹ Ibid., 202-203.

²⁰ Ibid., 191-192.

environment the operational commander wants to achieve, from the beginning to the end state. Throughout the phases of an operation, the operational commander develops situational models of the operating environment. Situational models focus on establishing factual representations of the operating environment through data collection. Data collection focuses only on those aspects of the environment that have the potential of invalidating the conceptual model. Disconfirming evidence is much more important than evidence that confirms the validity of the conceptual model because it prompts a comparison between the conceptual and situational models.²¹

CECA phases described

The *critique* phase of the CECA loop identifies critical aspects of the conceptual model that, if invalidated, would make the operational plan untenable. The identified critical aspects of the conceptual model then drive the development of specific information needs. The *explore* phase focuses on data collection. There are two methods to collect data: active and passive. Active data collection involves dedicating resources to collect data that support the commander's specified information needs. Passive data collection involves applying filters to the continuous stream of data that flow automatically from sensor inputs. Criteria for data filters include balancing competing needs for detecting unforeseen events and the limiting the volume of data processing within the C2 organization. Actively- and passively-collected data are synthesized to update the situational model. The *compare* phase looks for discontinuities between the conceptual and situational models. Staffs must pay specific attention to the operational commander's articulated concerns and highlight aspects of the situational model that invalidate the conceptual model. Finally, in the *adapt* phase, the operational commander responds to the discontinuities between the conceptual and situational models. The response, or *decision*, is nominally a selection between three choices: (a) do nothing because the discontinuities are

²¹ Bryant, "Rethinking OODA," 193-194.

insignificant, (b) modify the means to achieve the goal, or (c) modify the goals because basic assumptions of the operational plan are invalid.²²

The Second Step: Trends and Negative Effects

Bandwidth Trends

The intended impact of NCW on C2 is to produce an environment that creates opportunities for better decisions because decision-makers at each level of warfare will possess a common knowledge of the operating environment, sensors will be more responsive, and entities at each level of warfare will be better connected.²³ Creating common knowledge requires networked systems to collect data, manipulate the data into information, and disseminate information via human-machine interfaces in formats that generate common knowledge throughout the operating environment. A by-product of networking systems to facilitate creating a common knowledge in the operating environment is an explosion in the availability and transmission of data throughout the operating environment.

The Director of the Defense Information Systems Agency recently quoted statistics to describe “successes” for NCW.²⁴ Specifically, data transmission bandwidth increased from 100 megabits per second (Mbps) for 500,000 troops in Operation Desert Storm to 3,200 Mbps for 350,000 troops in Operation Iraqi Freedom. Installation of fiber optic transmission cables in Southwest Asia increased by a factor of 138, and conduct of video-teleconferences (VTC) to support wartime C2 increased by a factor of 22 since September 11, 2001.²⁵ Additionally, planned satellite launches will even further increase the bandwidth available to deployed forces, resulting in an increased capability for data flow.²⁶

²² Bryant, “Rethinking OODA,” 194-195.

²³ Alberts et al., *Network Centric Warfare*, 158-159.

²⁴ Harry D. Radeuge, Jr., “Net-Centric Warfare is Changing the Battlefield Environment,” *Crosstalk*, January 2004. <http://www.stsc.hill.af.mil/> (accessed 13 October 2007).

²⁵ Ibid.

²⁶ “2007 Space Almanac,” *Air Force Magazine* 90, no. 8 (August 2007): 87-90.

Saturation

In describing the benefits of increased information-handling capacity, Admiral William Owens claimed that “the emerging system of systems promises the capacity to use military force without the same risks as before—it suggests we will dissipate the ‘fog of war.’”²⁷ The suggestion that more networked systems and higher data and information-handling capacity can lift the “fog of war” seems contrary to fundamental concepts of operational art. In his discussion on military genius, Carl von Clausewitz states “usually, of course, new information and reevaluation are not enough to make us give up our intentions: they only call them into question. We now know more, but this makes us more, not less uncertain.”²⁸ Clausewitz reveals operational commander’s struggle to determine the pertinent information from the useless, and more information exacerbates this struggle. *Joint Vision 2020* warns that modern information systems and processes introduce unique sources of friction and fog into the operating environment.²⁹ A fog of war can descend on the operational commander through saturation with data, information, and technology. Access to instant communications, reach back through all levels in the chain of command, and endless streams of data and information directly from sensors saturates decision-makers and adds to the fog of war.³⁰

In addition to adding to the fog of war by overloading the commander and complicating the decision-making process, saturation can result in decision paralysis. With a high volume of data and information, relevant information may become indistinguishable from the irrelevant, important from the unimportant.³¹ Sorting through larger quantities of data and information

²⁷ William Owens, “System of Systems”, *Armed Forces Journal International*, January 1996, 47.

²⁸ Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (1976; repr., New York: Random House, 1993), 117.

²⁹ Chairman, U.S. Joint Chiefs of Staff, *JV 2020*, 12-13.

³⁰ Timothy L. Thomas, “Kosovo and the Current Myth of Information Superiority,” *Parameters* 30, no. 1 (Spring 2000): 23.

³¹ Demetrios J. Nicholson, “‘Seeing the Other Side of the Hill’: The Art of Battle Command, Decisionmaking, Uncertainty, and the Information Superiority Complex,” *Military Review* 85, no. 6 (November/December 2005): 61.

complicates judging their relevance and quality.³² The key piece of information required to make a decision may come from only a small fraction of the data collected and analyzed, but the key information may remain hidden in a haystack of data and informational noise.³³ A key concept must not be lost here. NCW can facilitate unfettered access to data *and* information. For the operational commander, decisions must be made based upon only pertinent information that invalidates the existing perception of the operating environment. In CECA model terms, pertinent information is that which indicates a discontinuity between the conceptual model and situational model. The operational commander must filter raw data and impertinent information so that only information pertinent to key operational decisions reaches the operational level.

In addition to delays induced by saturation, commanders can delay key decisions by waiting for a piece of critical information. The critical information may either be masked by the volume of information available or not be there at all.³⁴ The existence of technologically advanced data systems, streaming video, and the vast intelligence resources in space instills a false sense of confidence that the required information will come, even though the optimum time to make the decision has passed. Having “information superiority” may lead one to assume that the key information must exist and it is only a matter of time before the information is revealed. An unrealistic belief that a “complete picture” exists can make a commander averse to taking a risk on a decision supported by incomplete information.³⁵

³² David C. Gompert, Irving Lachow, and Justin Perkins, *Battle-Wise: Seeking Time-Information Superiority in Networked Warfare* (Washington, DC: National Defense University Press, 2006), 26, <http://www.ndu.edu/CTNSP/publications.html> (accessed 11 October 2007).

³³ Zimm, “Human-centric warfare”, 29.

³⁴ Demetrios J. Nicholson, “‘Seeing the Other Side of the Hill’: The Art of Battle Command, Decisionmaking, Uncertainty, and the Information Superiority Complex,” *Military Review* 85, no. 6 (November/December 2005): 61.

³⁵ Milan N. Vego, “Net-centric is not decisive,” *United States Naval Institute Proceedings* 129, no. 1 (January 2003): 55.

C2 and NCW

NCW and supporting technologies can facilitate pushing decisions down to lower levels of command. By exploiting networked sensors and communications systems, unit commanders can determine information from non-organic data sources and make decisions. Employing NCW in this fashion would be a positive example of how NCW empowers subordinate commanders to make decisions, thereby decentralizing C2. NCW can create conditions that generate the opposite effect, resulting in more centralized C2.³⁶ Operational decision-making ability degrades through a growing tendency of operational commanders to focus on tactical-level decisions rather than operational-level decisions.³⁷ Widely dispersed data and information throughout the strategic, operational, and tactical levels of war and the communications connections that exist between them blur the formerly distinct boundaries between the three levels of war.³⁸ NCW provides tactical battlefield information at the operational level, resulting in the operational commander having access to detailed bits of data and information. The opportunity then exists for the operational commander to reach down through sensor and communications networks and make decisions at the tactical level, effectively increasing the centralization of command.³⁹

The ability to reach down to the tactical level gives the commander a “virtual presence” that can interfere in local decisions. The result is a tendency to creep toward micromanagement.⁴⁰ Increased micromanagement is frustrating for subordinate commanders, distracts the operational commander from higher-level operational decisions, and stymies the

³⁶ Valérie Merindol and David W. Versailles, “Towards a Reinterpretation of Information Communication Technologies’ Impact on Command and Control,” *Defence Studies* 7, no. 2 (June 2007): 242.

³⁷ Milan N. Vego, “Operational Command and Control in the Information Age,” *Joint Force Quarterly*, no 35 (2004): 102.

³⁸ David C. Gompert, Irving Lachow, and Justin Perkins, *Battle-Wise: Seeking Time-Information Superiority in Networked Warfare* (Washington, DC: National Defense University Press, 2006), 132, <http://www.ndu.edu/CTNSP/publications/> accessed 11 October 2007.

³⁹ Milan N. Vego, “Net-centric is not decisive,” *United States Naval Institute Proceedings* 129, no. 1 (January 2003): 53.

⁴⁰ Merindol and Versailles, “Information Communications Technologies’ Impact,” 246.

development of subordinate commanders to make independent decisions. Conversely, developing a practice of constant consultation with higher authority can atrophy decision-making skills that existed in a non-NCW environment.⁴¹ Officers at the tactical and operational levels lose their skills to make a decision without consulting their immediate superior. The longer these phenomena exist, the more military officers will mature in an operational environment where the ability to make an independent critical decision is never developed.

Centralized C2 facilitated by NCW and supporting technologies reveals two vulnerabilities. First, disruption in communications or information flow would significantly degrade the commander's ability to make decisions and promulgate orders. Second, decisions at subordinate levels would be degraded by the inability of subordinates to confer with the higher authority or make a risky decision.⁴² The overall negative effects are an increasing trend in centralizing C2 and reducing capacity for decision-making at lower levels.

Decentralized Headquarters

The evolution of communications technologies and the capabilities introduced by NCW provide flexible options for staffing a joint force headquarters. Component commands can retain their staff and headquarters in a physical location far from the joint operating area. Remote joint force headquarters complicate C2 tasks in a variety of ways. The time-zone difference between the joint force headquarters and functional component commanders can complicate the decision-making process since staff battle rhythms are not synchronized. A sound battle rhythm facilitates decision-making.⁴³ Exercising control through VTC can significantly reduce travel requirements for operational commanders and minimize the movement of support staffs to

⁴¹ Merindol and Versailles, "Information Communications Technologies' Impact," 250.

⁴² Ibid., 250.

⁴³ JP 3-0, *Joint Operations*, 3.3.

forward areas of operations.⁴⁴ VTCs, however, carry additional administrative requirements for remote joint staffs and can become “a voracious consumer of leadership and key staff working hours.”⁴⁵ While communications systems and the principles of NCW provide opportunities for decentralizing C2 architecture, doing so does not necessarily enhance C2.

Combining centralized C2 and decentralized headquarters is inherently risky. Staffs separated from the operational commander by thousands of miles experience new forms of friction that significantly complicate planning and execution. Exercising centralized authority via VTC provides only small windows throughout the day during which staffs can get decisions. Outside of those windows of opportunity, the operational commander is typically unavailable, especially if there is a significant difference in time zones between the area of operations and the operational commander.⁴⁶ Loss of ability to conduct secure VTCs from various remote locations would significantly hamper the flow of decisions to actions, especially while staffs relocated or C2 hierarchy restructured.

CONCLUSIONS

The emergence of NCW and information technologies has significantly increased the volume of data and information flow in the operating environment. The large volume of data and information can have significant negative effects on operational C2 if the operational commander does not implement measures to maximize efficient use of information while minimizing vulnerability to disruption in C2. Much of the fog of war induced by data and information saturation is caused by unrestricted access to data and irrelevant information. Furthermore, the ability for the operational commander to reach to the tactical level and the

⁴⁴ Alberts et al., *Network Centric Warfare*, 109-110.

⁴⁵ Elaine Grossman, “U.S. Commander in Kosovo Sees Low-tech Threats to High-tech Warfare,” *Inside the Pentagon*, 9 September 1999.

⁴⁶ Benjamin S. Lambeth, *NATO's Air War for Kosovo: A Strategic and Operational Assessment* (Santa Monica, CA: RAND Corporation, 2001), 217.

connectivity throughout the strategic, operational, and tactical levels can result in centralization of C2 and under-development of decision-making skills at subordinate levels of command.

These adverse effects do not lead to the conclusion that NCW should be abandoned. NCW can be highly effective at the tactical level of war where unit commanders rely more on discrete elements of the environment to make decisions.⁴⁷ The operational commander must be wary of the possible effects NCW and information technologies may have on the decision-making process. More data at the operational level does not necessarily create more information critical to the operational commander's decision-making requirements. Similarly, information superiority does not equate to operational advantage or better decision-making.⁴⁸ The operational commander's employment of NCW and supporting technologies should streamline data and information management to support operational-level decisions and minimize vulnerabilities presented in a disruptive C2 environment.

The overarching way to minimize vulnerabilities in NCW and supporting technologies is to reduce the volume of data and information flow throughout the levels warfare in the operating environment and instituting policies that enhance decision-making at the operational level. The operational commander can reduce information flow by effective delegation of authority, paying particular attention to key phases in the operational planning process, and creative construction of a joint task force headquarters.

⁴⁷ Milan N. Vego, "Net-centric is not decisive," *United States Naval Institute Proceedings* 129, no. 1 (January 2003): 53, 55.

⁴⁸ *Joint Vision 2020*, 12.

RECOMMENDATIONS

Delegation of Authority.

Joint doctrine repeats a fundamental consideration for conducting operations: centralized planning and decentralized execution.⁴⁹ If this fundamental tenet is so prevalent in joint doctrine, then why do commanders delve into the details of specific targets, photographs, and weapons systems?⁵⁰ What does “decentralize execution” mean? In practice, delegating authority and decision-making to the lowest possible level is extremely difficult to achieve. One perspective presents the idea that joint doctrine concepts of centralizing control and decentralizing execution are contradictory and cannot exist simultaneously.⁵¹ One definition of decentralized control is: “delegation of authority to issue orders to subordinate commanders or subordinate elements of a command and control system to accomplish their assigned tasks.”⁵² A key word in this definition is *task*. Task- or mission-oriented command and control can have limitations that predominantly reside in inter-personal rivalries and mistrust. Breaking down personal barriers, developing trust and confidence in subordinates, and sharing common knowledge of the operating environment facilitates mission-oriented command and control, thereby enabling more independent operations at the tactical level of operations.⁵³

Sharing a common framework of operations requires that the commander effectively communicate the conceptual model to subordinate commanders. The commander accomplishes this through mission-oriented commander’s intent and mission orders. Delegating execution

⁴⁹ Chairman, U.S. Joint Chiefs of Staff, *Command and Control for Joint Land Operations*, JP 3-31 (Washington, DC: CJCS, 23 March 2004), v; Chairman, U.S. Joint Chiefs of Staff, *Command and Control for Joint Air Operations*, JP 3-30 (Washington, DC: CJCS, 5 June 2003), 1.2; Chairman, U.S. Joint Chiefs of Staff, *Information Operations*, JP 3-13 (Washington, DC: CJCS, 13 February 2006), 4.2.

⁵⁰ Lambeth, *NATO’s Air War*, 191.

⁵¹ Mark G. Davis, “Centralized Control/Decentralized Execution in the Era of Forward Reach,” *Joint Force Quarterly*, no. 35 (2004): 95.

⁵² Woody W. Parramore, “Defining Decentralized Execution in Order to Recognize Centralized Execution,” *Air & Space Power Journal* 18, no. 3 (Fall 2004): 25.

⁵³ Vego, “Operational Command and Control,” 106-107.

authority can only be successful if the decisions made below the operational commander are consistent with commander's intent. Therefore, success relies not upon the degree to which data and information sharing exists throughout the C2 structure, but the degree to which the commander's conceptual model is shared throughout the C2 structure. Tactical and intermediate commanders that have common knowledge of an operation's conceptual model make decisions consistent with the commander's intent.⁵⁴ The determining factor may then become the operational commander's trust in subordinate commander decision-making abilities. Mission-oriented orders allow subordinate commanders to choose the appropriate means of accomplishment without restricting freedom of action. Understanding commander's intent allows subordinate commanders to exercise initiative and act in a manner consistent with the commander's desires.⁵⁵

Developing a clear commander's intent that communicates the commander's conceptual model and issuing mission orders empowers subordinate commanders to make decisions. More decisions at the lower levels of command reduce the decision-making burden on the operational commander. The benefits also include reduced strain on communications systems by reducing commander's information requirements. Finally, subordinate commanders maintain the skills to make independent decisions. These benefits reduce vulnerabilities imposed by a disruptive C2 environment by optimizing decision-making abilities below the operational level, facilitating maintaining high operational tempo.

Minimizing Information Volume

Uncontrolled data and information flow saturate the commander with meaningless noise. To avoid saturation, the commander must implement controls to reduce the amount of data collected and information transmitted throughout the operating environment. Avoiding

⁵⁴ Bryant, "Rethinking OODA," 190.

⁵⁵ Van Riper, "Information Superiority," 59.

saturation limits the fog of war induced by abundant information and reduces communications infrastructure requirements. The basis of minimizing information volume lies within the operational planning process. The operational commander can use the planning process to minimize information volume in the operating environment through careful development of information requirements, continuous validation of assumptions, and wargaming.

Active data collection uses intelligence collection resources, sensors, and tactical units to seek out and report data that meets the commander's specific requirements.⁵⁶ The commander's critical information requirements (CCIRs) establish the criteria for the commander's requirements and are a key output of mission analysis.⁵⁷ CCIRs are selective in nature, thereby reducing information volume to only that which is relevant. The operational commander can use the CECA model as an aid to developing CCIRs. During the planning process, planners identify critical aspects of the conceptual model that, if invalidated, would prompt a decision. Using this model provides a more narrow focus on generating CCIRs than joint doctrine.⁵⁸ With a narrower focus, collecting information to support CCIRs is more targeted, lending itself to greater efficiency and reduced information volume.

Assumptions are a critical element of planning and must be constantly evaluated to ensure they remain valid.⁵⁹ The commander can effectively use passive data collection to provide information that may invalidate the underlying assumptions in the conceptual model of the existing state of the operation. Passive data collection produces a continuous stream of data from automatic sensors and routine processes. The commander must apply a filter to this stream to avoid saturation.⁶⁰ Limiting passive data collection to support assumption verification

⁵⁶ Bryant, "Rethinking OODA," 191.

⁵⁷ JP 3-0, *Joint Operations*, 3.1.

⁵⁸ Chairman, U.S. Joint Chiefs of Staff, *Joint Operation Planning*, JP 5-0, (Washington, DC: CJCS, 26 December 2006): 3.27.

⁵⁹ JP 5-0, *Joint Operation Planning*, 3.26.

⁶⁰ Bryant, "Rethinking OODA," 194.

restricts the amount of information presented to the commander to only that which is necessary to invalidate an assumption, ultimately reducing information flow.

Some assumptions relevant to operational planning may be concerned with maintaining certain capabilities throughout and operation. In a disruptive C2 environment, communications and information capabilities may not be guaranteed. Assumptions about continuity of communications and information availability throughout operations may not remain valid. One of the decisions a commander must make is when and how to change the plan if the need arises.⁶¹ Prudent planning would account for possible reduced communications and information-handling capability. Once assumptions regarding requirements for communications are invalidated, the commander would be triggered to implement a branch plan, adapting the operational plan to continue to work toward achieving objectives in a new environment. Commander's guidance must address potential degradation in communications and data transmission capacity and require a branch plan to take effect if the degradation becomes a reality.

The commander assesses the operational plan, including its assumptions, through wargaming. Wargaming can provide the operational commander insight and prompt creativity that may not otherwise occur in planning.⁶² By testing CCIRs, reduced data and information volume, and assessing branch plans, the operational commander can get an appreciation of the potential landscape in a C2 disruptive environment. Most importantly, wargaming and exercises provide the opportunity for the operational commander and subordinate commanders to practice operations with limited data, information, and communications resources. Wargames and exercises test the plans and reveal inadequacies. Additionally, subordinate commanders can

⁶¹ Bryant, "Rethinking OODA," 195.

⁶² JP 5-0, *Joint Operation Planning*, 3.31.

develop decision-making skills and build relationships between levels of command founded upon trust and confidence.

Building a Joint Staff

In building a joint staff and C2 structure, the commander must keep in mind the possible effects of reduced information-handling capability. Locating a headquarters in or near a joint operating area eliminates the complications introduced by long distances between the JFC and subordinate commanders. Collocation allows synchronizing staff battle rhythms, facilitating more efficient staff operations.⁶³ Physical co-location of JFC staff and subordinate functional or service component staffs has several advantages. First, there is less stress on the communications infrastructure, especially if space-based capability is degraded because of adversary action. Minimizing the number of times information is received, processed, and forwarded through communications centers and nodes reduces the burden on communications systems. Information is not distorted or colored by the media by which it is transmitted if transmissions and alterations are minimized. Second, face to face interactions, socialization, personal relationships, and non-verbal communication facilitates a shared knowledge of the conceptual model within the C2 hierarchy.⁶⁴ Daily face-to-face interactions between the operational commander and subordinate commanders develop working relationships and builds trust, facilitating delegation of authority and issuance of mission orders.⁶⁵ Third, decisions can actually occur more rapidly. Coupled with increased shared awareness, shorter physical distances over which information travels, and synchronization of battle rhythms, the time it takes for an operational commander to receive information, think about it, decide, and deliver an answer or order is shortened when the operational commander is in close physical proximity to

⁶³ Vego, "Operational Command and Control," 103.

⁶⁴ Merindol and Versailles, "Information Communications Technologies' Impact," 246.

⁶⁵ Lambeth, *NATO's Air War*, 217.

the theater and staffs.⁶⁶ Finally, collocating commanders reduces data-handling requirements on communications systems. Fewer VTCs, emails, and conference calls reduce the burden on infrastructure. Degradation in communications systems would have a lesser effect on the ability of the staffs to function and make decisions on a daily basis.

Joint staff composition is also vitally important to successful operations. In an operating environment where the adversary places information superiority at risk, the commander will require staff expertise and resources to manage the dynamics of changing information resources.⁶⁷ The commander should consider augmentation staffs to enhance the ability to manage problems with information resources. Augmentation staffs include a joint communications support element (JCSE), national intelligence support team (NIST), joint information operations warfare command, joint communications security monitoring activity (JCSA), and joint space support team (JSST).⁶⁸ These staffs all function to manage information infrastructure and resources. In an environment where information superiority is at risk, a special subordinate task force, led by the staff J-6, would supervise and coordinate the activities of these augmentation staffs to optimize information support for C2.

Other staff options exist outside of joint doctrine. As warfare evolves into effects-based operations characterized by simultaneous operations across space, air, land, sea, and information domains, the commander must think more along functional lines than domain lines. Elements from each domain can participate in delivering an effect. For example, force from the sea in concert with air power and artillery can conduct precise and simultaneous strikes on land.⁶⁹ One staff hierarchy adopts the concept of functional commanders even more comprehensively than

⁶⁶ Vego, "Operational Command and Control," 103.

⁶⁷ JP 3-13, *Information Operations*, 1.5.

⁶⁸ Chairman, U.S. Joint Chiefs of Staff, *Joint Task Force Headquarters*, JP 3-33, (Washington, DC: CJCS, 16 February 2007): 2.1 – 2.5; and Chairman, U.S. Joint Chiefs of Staff, *Joint Doctrine for Space Operations*, JP 3-14, (Washington, DC: CJCS, 9 August 2002): 2.5

⁶⁹ Michael P. Noonan and Mark R. Lewis, "Conquering the Elements: Thoughts on Joint Force (Re)Organization," *Parameters*, Autumn 2003, 36.

today's joint air, land, and maritime component commanders. Functional commands in this new construct are "organized along strike, security, support, and information operations commands."⁷⁰ Within this operational construct, the Joint Information Operations Component Commander (JIOCC) staff would be embedded with expertise across the services to more efficiently manage information throughout the operating environment. This construct concentrates the expertise from all services in one staff, rather than diluting it across the various J6 staffs in today's Joint Task Force structure.

⁷⁰ Michael P. Noonan and Mark R. Lewis, "Conquering the Elements: Thoughts on Joint Force (Re)Organization," *Parameters*, Autumn 2003, 41.

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